Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-3. (Canceled)

4. (Currently Amended) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning unit for irradiating said charged particle beam converged by said charged particle optical system to said sample in order to scan said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment unit for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection unit for obtaining a plurality of 2-dimensional particle images by detection of a particle images generated by said sample scanned by the irradiation of said charged particle beam converged by said charged particle optical system, where a single 2-dimensional particle image is obtained for each focal position;

an image processing unit for computing a focal offset and said astigmatism of said converged charged particle beam on the basis of said plurality of 2-dimensional particle images obtained by said particle image detection unit at different focal positions controlled by said focal position control system; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing unit to said astigmatism adjustment,

wherein a cross-sectional shape of said charged particle beam at an astigmatism adjusted focal position is circle and said image processing means computes said astigmatism by using at least three directional sharpness magnitudes which are obtained from said single 2-dimensional particle image at each focal position,

wherein said charged particle beam apparatus creates a pattern, said pattern including edge components in at least 3 directions on said sample,~~A charged particle beam apparatus according to claim 3, wherein said charged particle beam apparatus creates said pattern including edge components in at least 3 directions,~~ said pattern having at least 3 areas, each of said areas for creating a sub pattern having one of said edge components in one of said directions on said sample.

5. (Canceled)

6. (Currently Amended) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning unit for irradiating said charged particle beam converged by said charged particle optical system to said sample in order to scan said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment unit for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection unit for obtaining a plurality of 2-dimensional particle images by detection of a particle images generated by said sample scanned by the irradiation of said charged particle beam converged by said charged particle optical system, where a single 2-dimensional particle image is obtained for each focal position;

an image processing unit for computing a focal offset and said astigmatism of said converged charged particle beam on the basis of said plurality of 2-dimensional particle images

obtained by said particle image detection unit at different focal positions controlled by said focal position control system; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing unit to said astigmatism adjustment,

wherein a cross-sectional shape of said charged particle beam at an astigmatism adjusted focal position is circle and said image processing means computes said astigmatism by using at least three directional sharpness magnitudes which are obtained from said single 2-dimensional particle image at each focal position, and~~A charged particle beam apparatus according to claim 1,~~

wherein said particle image detection unit detects a particle image generated from said sample serving as an object substrate as a result of radiation of said converged charged particle beam with at least said astigmatism adjusted and controlled by said control system to said object substrate in a scanning operation carried out by using said scanning unit; and

a defect inspection image processing unit is provided for inspecting said object substrate for a defect existing on said object substrate on the basis of said detected particle image.

7-8. (Canceled)

9. (Currently Amended) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning unit for irradiating said charged particle beam converged by said charged particle optical system to said sample in order to scan said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment unit for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection unit for obtaining a plurality of 2-dimensional particle images by detection of a particle images generated by said sample scanned by the irradiation of said charged particle beam converged by said charged particle optical system, where a single 2-dimensional particle image is obtained for each focal position;

an image processing unit for computing a focal offset and said astigmatism of said converged charged particle beam on the basis of said plurality of 2-dimensional particle images obtained by said particle image detection unit at different focal positions controlled by said focal position control system; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing unit to said astigmatism adjustment,

wherein a cross-sectional shape of said charged particle beam at an astigmatism adjusted focal position is circle and said image processing means computes said astigmatism by using at least three directional sharpness magnitudes which are obtained from said single 2-dimensional particle image at each focal position,

wherein said particle image detection unit detects a particle image generated from said sample serving as an object substrate as a result of irradiation of said converged charged particle beam with at least said astigmatism adjusted and controlled by said control system to said object substrate in a scanning operation carried out by using said scanning unit, and a measurement image processing unit is provided for measuring dimensions of a pattern existing on said object substrate on the basis of said detected particle image, and ~~A charged particle beam apparatus according to claim 8,~~

wherein control of said focal position control system is based on a height on said object substrate optically detected by a height detection sensor further provided for optically detecting a height on said object substrate.

10-12. (Canceled)

13. (Currently Amended) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning means for irradiating and scanning said charged particle beam converged by said charged particle optical system on a surface of said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment means for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection means for obtaining a single 2-dimensional particle image at each focal position by changing focal position with use of said focal position control system and detecting particles generated from a surface of said sample by the irradiation and the scanning of said charged particle beam with use of said scanning means;

an image processing means for computing said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle images at each focal position obtained by said particle image detection means; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing means to said astigmatism adjustment means,

wherein said image processing means computes said astigmatism of said converged charged particle beam from a relation among in focus positions at directional sharpness magnitudes for at least 3 directions by finding said directional sharpness magnitudes for at least said 3 directions for a plurality of focal position positions from said 2 dimensional particle image with a plurality of focal position positions obtained by said particle image detection means and then finding said in focus positions at said found directional sharpness magnitudes for at least said 3 directions, and ~~A charged particle beam apparatus according to claim 12,~~

wherein said control system for adjusting and controlling further provides adjusting and controlling of said focal position of said converged charged particle beam by feeding back a focal position correction quantity based on said focal offset computed by said image processing means to said focal position control system.

14-18. (Canceled)

19. (Currently Amended) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning means for irradiating and scanning said charged particle beam converged by said charged particle optical system on a surface of said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment means for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection means for obtaining a single 2-dimensional particle image at each focal position by changing focal position with use of said focal position control system and detecting particles generated from a surface of said sample by the irradiation and the scanning of said charged particle beam with use of said scanning means;

an image processing means for computing said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle images at each focal position obtained by said particle image detection means; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing means to said astigmatism adjustment means,

wherein said charged particle beam apparatus is characterized in that said particle image detection means has a configuration wherein a particle image having a plurality of

different focal positions is detected from a plurality of different areas on said sample, and ~~A charged particle beam apparatus according to claim 18,~~

wherein said sample is inclined or has a staircase like surface.

20-22. (Canceled)

23. (Currently Amended) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning means for irradiating and scanning said charged particle beam converged by said charged particle optical system on a surface of said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment means for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection means for obtaining a single 2-dimensional particle image at each focal position by changing focal position with use of said focal position control system and detecting particles generated from a surface of said sample by the irradiation and the scanning of said charged particle beam with use of said scanning means;

an image processing means for computing said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle images at each focal position obtained by said particle image detection means; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing means to said astigmatism adjustment means,

wherein said image processing means computes said astigmatism of said converged charged particle beam from a relation among in focus positions at directional sharpness magnitudes for at least 3 directions by finding said directional sharpness magnitudes

for at least said 3 directions for a plurality of focal position positions from said 2 dimensional particle image with a plurality of focal position positions obtained by said particle image detection means and then finding said in focus positions at said found directional sharpness magnitudes for at least said 3 directions,

~~A charged particle beam apparatus according to claim 12,~~ wherein said image processing means determines an in focus position for each of directional sharpness magnitudes as a center of gravity of an area enclosed by a segment of a curve and a horizontal line representing a threshold value where said curve represents variations of each of said directional sharpness magnitudes with respect to said in focus position whereas said segment represents said variations exceeding said threshold value.

24. (Original) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning means for irradiating and scanning said charged particle beam converged by said charged particle optical system on a surface of said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment means for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection means for obtaining a single 2-dimensional particle image at each focal position by changing focal position with use of said focal position control system and detecting particles generated from a surface of said sample by the irradiation and the scanning of said charged particle beam with use of said scanning means;

an image processing means for computing said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle images at each focal position obtained by said particle image detection means; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing means to said astigmatism adjustment means,

wherein said image processing means computes said astigmatism of said converged charged particle beam from a relation among in focus positions at directional sharpness magnitudes for at least 3 directions by finding said directional sharpness magnitudes for at least said 3 directions for a plurality of focal position positions from said 2 dimensional particle image with a plurality of focal position positions obtained by said particle image detection means and then finding said in focus positions at said found directional sharpness magnitudes for at least said 3 directions, ~~A charged particle beam apparatus according claim 12,~~

wherein said image processing means determines said in focus position for each of directional sharpness magnitudes by:

computing a degree of matching between a curve representing variations of an evaluation value with respect to each of said directional sharpness magnitudes and any one of curves of image inversion which are each symmetrical with respect to an axis of symmetry on the right and left sides of said axis of symmetry;

determining a specific one of said curves of image inversion with a highest degree of matching; and

using the position of an axis of symmetry of said specific curve of image inversion as said in focus position.

25. (Currently Amended) A charged particle beam apparatus comprising:

a stage for setting a sample;

a charged particle optical system for converging a charged particle beam emitted by a charged particle source;

a scanning means for irradiating and scanning said charged particle beam converged by said charged particle optical system on a surface of said sample;

a focal position control system for controlling a focal position of said charged particle beam converged by said charged particle optical system;

an astigmatism adjustment means for adjusting astigmatism of said charged particle beam converged by said charged particle optical system;

a particle image detection means for obtaining a single 2-dimensional particle image at each focal position by changing focal position with use of said focal position control system and detecting particles generated from a surface of said sample by the irradiation and the scanning of said charged particle beam with use of said scanning means;

an image processing means for computing said astigmatism of said converged charged particle beam on the basis of said 2 dimensional particle images at each focal position obtained by said particle image detection means; and

a control system for adjusting and controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity based on said astigmatism computed by said image processing means to said astigmatism adjustment means,

wherein said image processing means computes said astigmatism of said converged charged particle beam from a relation among in focus positions at directional sharpness magnitudes for at least 3 directions by finding said directional sharpness magnitudes for at least said 3 directions for a plurality of focal position positions from said 2 dimensional particle image with a plurality of focal position positions obtained by said particle image detection means and then finding said in focus positions at said found directional sharpness magnitudes for at least said 3 directions,

wherein ~~A charged particle beam apparatus according to claim 12,~~ said charged particle beam apparatus further comprises ~~comprising~~:

a standard sample is provided for calibration purposes at a location adjacent to an object substrate;

at least astigmatism or a focal position is corrected on said standard sample prior to an observation, an inspection or a measurement of said object substrate or periodically;

wherein said observation, said inspection or said measurement of said object substrate is carried out in a state of corrected astigmatism or a corrected focal position.

26-33. (Canceled)

34. (Original) An automatic astigmatism adjustment method comprising:

converging a charged particle beam emitted from a charged particle source;

irradiating said converged charged particle beam to a sample with a pattern formed thereon;

obtaining a plurality of 2 dimensional particle images having different focal positions of said converged particle beam by detection of particles generated from said sample by said radiating;

computing directional sharpness magnitudes for at least 3 directions for a plurality of focal position positions from said plurality of 2 dimensional particle images;

computing in focus positions using said computed directional sharpness magnitudes for at least said 3 directions;

computing astigmatism of said converged charged particle beam from a relation among said computed in focus positions at said computed directional sharpness magnitudes for at least said 3 directions; and

controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity computed based on said astigmatism; and said focal position of said converged charged particle beam by feeding back a focal position correction quantity computed based on said in focus positions, ~~An automatic astigmatism adjustment method according to claim 31,~~

wherein said computing an in focus position using said computed directional sharpness magnitudes further comprises:

computing a center of gravity of an area enclosed by a segment of a curve and a horizontal line representing a threshold value where said curve represents variations of each of said computed directional sharpness magnitudes with respect to said in focus position; and wherein said segment represents said variations exceeding said threshold value.

35. (Original) An automatic astigmatism adjustment method comprising:

converging a charged particle beam emitted from a charged particle source;

irradiating said converged charged particle beam to a sample with a pattern formed thereon;

obtaining a plurality of 2 dimensional particle images having different focal positions of said converged particle beam by detection of particles generated from said sample by said radiating;

computing directional sharpness magnitudes for at least 3 directions for a plurality of focal position positions from said plurality of 2 dimensional particle images;

computing in focus positions using said computed directional sharpness magnitudes for at least said 3 directions;

computing astigmatism of said converged charged particle beam from a relation among said computed in focus positions at said computed directional sharpness magnitudes for at least said 3 directions; and

controlling said astigmatism of said converged charged particle beam by feeding back an astigmatism correction quantity computed based on said astigmatism; and said focal position of said converged charged particle beam by feeding back a focal position correction quantity computed based on said in focus positions, ~~An automatic astigmatism adjustment method according to claim 31,~~

wherein said computing an in focus position using said computed directional sharpness magnitudes further comprises:

computing a degree of matching between a curve representing variations of an evaluation value with respect to each of said directional sharpness magnitudes and any one of curves of image inversion which are each symmetrical with respect to an axis of symmetry on the right and left sides of said axis of symmetry;

determining a specific one of said curves of image inversion with a highest degree of matching; and

using the position of an axis of symmetry of said specific curve of image inversion as said in focus position.

36. Canceled.